

**DISPOSABLE OUTLET PATIENT FLOW LINE EMPLOYING
ACTIVE WARMING AND PASSIVE INSULATION TO PROVIDE
NORMOTHERMIC FLUID AT VERY LOW FLOW RATES FOR
IN-LINE BLOOD WARMERS**

Abstract: A disposable outlet patient flow line for in-line blood/fluid warmer devices uses both passive insulation and active warming to deliver normothermic intravenous fluid to the patient connection site at very low flow rates. A co-extruded annular air space provides passive insulation which reduces heat loss to the cooler ambient air, but by itself this is inadequate for flow rates less than about 15 milliliters per minute.

Temperature controlled heating elements located inside the annular air space replace heat lost to ambient air outside the flow line, maintaining the annular air space at about 42 degrees C, thus preventing heat loss from the central blood/fluid carrying lumen. Normothermic fluid is delivered to the patient at body temperature down to essentially zero flow rate, using a low cost, convenient disposable outlet patient flow line.